

Title	MEDUSAE OF EUGYMNANTHEA, AN EPIZOIC HYDROID
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Citation	PUBLICATIONS OF THE SETO MARINE BIOLOGICAL LABORATORY (1964), 12(1): 101-107
Issue Date	1964-06-30
URL	<a href="http://hdl.handle.net/2433/175349">http://hdl.handle.net/2433/175349</a>
Right	
Type	Departmental Bulletin Paper
Textversion	publisher

## MEDUSAE OF *EUGYMNANTHEA*, AN EPIZOIC HYDROID<sup>1)2)</sup>

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*With 6 Text-figures*

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While staying at the Zoological Station of Naples in the autumn of 1958, the writer found two hydromedusae belonging to the Leptomedusae among plankton obtained at depths of 10 and 15 m. These medusae were active swimmers and appeared to be very peculiar in respect to their small size and well-developed gonads. On closer examination they seemed to be eligible for *Eugymnanthea*, an epizoic hydroid genus on bivalves, first reported by PALOMBI from Naples in 1935. A report was therefore written and sent to the Naples Station, but identification of the medusae with that genus was denied by zoologists staying at the station, because these medusan specimens are apparently different from medusa of *Eugymnanthea inquilina*. Recently, through the kindness of Prof. E. HIRAI and Miss Y. KAKINUMA of the Asamushi Marine Biological Station, the present writer saw sketches and photographs of medusae liberated from polyps of *Eugymnanthea* which is parasitic on the bivalve, *Mytilus edulis* in Hachinoé, northern Japan. The medusa nearly agrees with those obtained by the writer in Naples, and will be described as a new species, *Eugymnanthea cirrifera* by the two investigators in the Bulletin of Asamushi Marine Biological Station, vol. 12, no. 1. In addition, some polyps of *Eugymnanthea* parasitic on the bivalve, *Mytilus coruscus*, also collected at Hachinoé, were reared in the Biological Laboratory in the Imperial Palace. They gave rise to several free medusae in July, 1963. These medusae seem to coincide with the medusae studied by HIRAI and KAKINUMA. From these facts it is clear that the typical medusa of *Eugymnanthea* seems to be those here reported and that *E. inquilina* is a degenerated form.

The description of the medusae collected by the writer from Naples is as follows.

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- 1) The research was financed in part by grant NONR 2100(00) of the Office of Naval Research in Washington through the ANTON & REINHARD DOHRN Foundation.
  - 2) Contributions from the Akkeshi Marine Biological Station, No. 123.

Publ. Seto Mar. Biol. Lab., XII (1), 1964. (Article 4)

The umbrella is almost hemispherical, 0.7 mm high and 0.88 mm wide in one specimen and 0.77 mm high and 0.99 mm wide in the other. The jelly is rather rigid. The stomach is four-sided. The manubrium is short, with a cruciform mouth having four lips. The wall of the stomach is composed of a layer of cylindrical mucous cells with nuclei arranged in a linear row, while the cells of the radial canals are granulated and more vesicular than the former. The four radial canals are narrow, straight and are connected at their bases to the ring canal. The gonads are well developed as thick oval bodies lying on

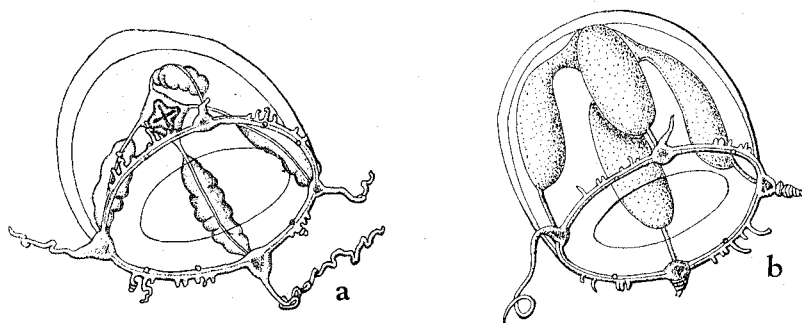


Fig. 1. Medusae of *Eugymnanthea minuta* n. sp.; a) 0.77 mm high  $\times$  0.99 mm wide and b) 0.7 mm high  $\times$  0.88 mm wide respectively.

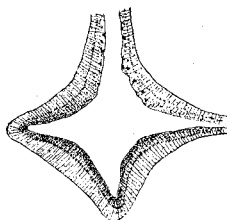


Fig. 2

Fig. 2. Cross section of manubrium showing connection with radial canals.

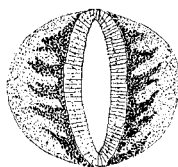


Fig. 3

Fig. 3. Cross section of testis encircling radial canal.

almost the entire length of the axial side of the radial canals. The gonads in the smaller specimen are smooth in outline, but those in the larger specimen are folded four or five times. In cross section the gonads nearly encircle the radial canals except for the short axial and abaxial parts. In the male gonads the spermatogonia and spermatocytes forming the inner layer are distinguishable from the outer layer containing spermatozoa. There are four perradial marginal tentacles, each with a swollen conical basal bulb. These tentacles are extensible, coil spirally and hollow at least in the basal bulb. In each quadrant between

the perradial tentacles there are from four to nine small marginal cirri. The sequence varied in each quadrant, being as 6, 4, 8, 9 in one specimen and 6, 6, 5, 6 in the other. The presence of eight statocysts, one in each adradius, is probably normal in the adult, but in the larger specimen, there are two statocysts in two quadrants; one in each adradius, and one in an adradius in one quadrant and one in the interradius in another quadrant. In the smaller specimen they are four, each located in the interradius of the bell margin. This arrangement of statocysts seems to be abnormal, but such a transitory arrangement is observed in young medusae of the genus *Eucheilota*<sup>1)</sup>. In these medusae, there are four statocysts at first, one in each interradius, and they gradually shift as new ones are added. The statocysts contain 3 or 4 otoliths. The medusae are colourless except for white gonads. The species resembles *Krampella dubia* RUSSELL in general shape, but is quite different in the presence of statocysts. The specimens were captured in Naples on Sept. 25, and Oct. 23, 1958.

Through the generosity of H. M. The Emperor the writer examined medusae and polyps of *Eugymnanthea* collected from Hachinoé and preserved in the Imperial Laboratory. The medusa just liberated from the polyps is 3 mm in diameter and 1.5 mm high. Exumbrella distinctly sprinkled with nematocysts. The medusa is furnished with a four-sided manubrium, four lips, four radial canals and a ring canal. Tentacles are four, one in each perradius, mounted on an enlarged basal bulb, hollow and extensile. On both sides and sometimes on the abaxial side as well are found narrow coiled cirri. In the interradiial portion there are found tentacle bulbs only. They are also provided with the lateral coiled cirri. In the adradial parts there are observed statocysts which are situated mostly on the ring canal in young medusae, but they gradually shift abaxially to beyond the bell margin. Gonads not yet developed on the radial canals. Tentacle base brown in colour. A medusa fixed five days after liberation is still higher than wide and provided with four lips in the mouth. A medusa fixed 20 days after liberation has the manubrium with

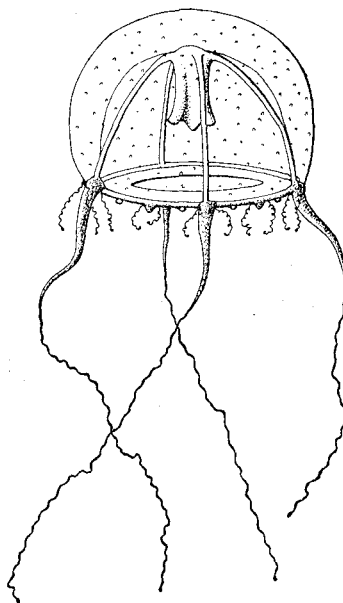


Fig. 4. Young medusa of *Eugymnanthea cirrifera* HIRAI and KAKINUMA, 3 mm in diameter, preserved in the Imperial Laboratory.

1) *E. duodecimalis* by G. MAYER (1910), *Medusae of the World*, vol. 2, p. 284 & *E. clausa* by F. S. RUSSEL (1936), *Jour. Mar. Biol. Assoc. U.K.*, vol. 21, p. 131.

four slightly crenulated lips and well developed adradial statocysts. Some of its perradial tentacles had lost cirri, and some cirri had shifted from interrarial tentacle bases to the free marginal portion. No gonads were observed in this stage.

So far as the sketches, photographs and notes show, the medusa studied by HIRAI and KAKINUMA, *E. cirrifera*, almost agrees with the medusa just described. It has four radial canals, a four-sided manubrium, four perradial tentacles with lateral cirri, four interrarial tentacle bulbs with lateral cirri and eight adradial statocysts. No medusa with gonads was obtained. It is highly probable that the two medusae from northern Japan will be united into a single species.

It seems obvious that the medusae collected by the writer in Naples and the two medusae from northern Japan agree each other with in general characters, but differ in several particular points; they are coincided with each other in the possession of four lips in the mouth, four radial canals, four perradial long extensile tentacles each arising from an enlarged tentacle-bulb and with coiled cirri, and eight adradial statocysts, but they are quite different in size, in interrarial tentacle bulbs and in the position of the cirri. The medusa from Naples is less than 1 mm in diameter and has well-developed gonads. The medusae from northern Japan are 2-3 mm in diameter when just liberated, without showing any sign of gonads. The interrarial tentacle bulbs are present in the young medusae from northern Japan, but are not seen in the adult from Naples. Coiled cirri are seen on tentacle bulbs in the young medusae of northern Japan, but they are distributed on the free margin of the adult medusa from Naples. But in the comparatively older specimen from Hachinoé cirri were observed to slightly disappear and sometimes to dislocate from the tentacle bulbs to the free margin. Therefore, it may be probable that the medusa from Naples also had cirri only on the tentacle bulbs in its younger stage. The interrarial tentacle bulbs, present in young medusae from Naples, may have degenerated in medusae with well-developed gonads. In any case, the medusa from Naples should be specifically separated from the medusae collected in northern Japan.

Now the writer will go on other species of the genus.

According to PALOMBI's description, the medusoid of *Eugymnanthea inquilina* is about 0.55 mm in height and width, and has 4 perradial tentacle-knobs only. It has neither marginal tentacles nor cirri on the bell margin. The base of the radial canals is only thickened to form tentacle bulbs in the perradial portions. The stomach is rudimental and lacks manubrium and mouth. There are eight statocysts, one in each adradial part of the bell-margin. Gonads, oval in shape and well-developed, are located one on each radial canal. The medusoids did not develop farther but were liberated and entered planktonic life from August to October. CROWELL (1957) who reared polyps and medusoids for several

months was unable to observe liberation of the medusoid up to May 6th. YAMADA, who worked in Naples for three years, informed the writer that the medusae he observed had neither manubrium nor mouth and agreed with the description given by PALOMBI. After liberation they discharged eggs or sperm and then died within a few days. So far as his observations go, some medusoids seem to emit sexual cells before liberation.

In 1941 CERRUTI described a new hydroid from the mussel *Mytilus galloprovincialis* at Taranto under the name of *Mitilhydra polimantii*. The species seems to be closely allied to the hydroid described above. CROWELL (1957) and YAMADA are of opinion that the latter species is synonymous with the former one. CERRUTI, who reared the polyps, stated that large medusa-buds were observed before September, but medusae with mature gonads were obtained in October-November, and some medusae obtained in plankton before October had poorly developed gonads. The medusa has four gonads, one on each radial canal and eight adradial statocysts on the margin. The perradial tentacles are represented by tentacle knobs. Between the tentacles one can see four small protuberances. The tentacle knobs, protuberances and gonads are pigmented. No manubrium and no mouth were found. The medusa of CERRUTI seems to be slightly different from the description of *Eugymnanthea inquilina*, not only in the pigmentation of the tentacles and gonads, but also in having four interradi al protuberances on the bell margin.

The writer examined five medusae of *Eugymnanthea inquilina* set free on June 23, 1959 from hydroids reared by YAMADA who kindly sent them from Naples to the writer for study. They were 24-30 hours old after liberation and equipped with matured gonads. They included both male and female specimens, one male measuring 1.1 mm high  $\times$  0.88 mm wide and one female 1.43 mm high

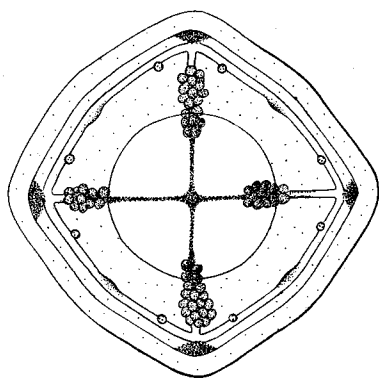


Fig. 5. Female medusa of *Eugymnanthea inquilina* set free from hydroid, 1.43 mm high  $\times$  1.98 mm wide.

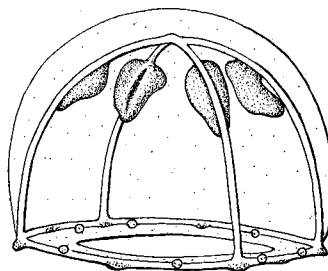


Fig. 6. Male medusa of *Eugymnanthea inquilina* set free from hydroid, 1.1 mm high  $\times$  0.88 mm wide.

×1.98 mm wide. These medusae are far larger than those described by PALOMBI and also than those taken by the writer. YAMADA's specimens generally agree with the original description of the species, but have four small interradian protuberances as in CERRUTI's description, which exhibit opaque particles on the abaxial side. Similar particles are observed at the perradian basal knobs and they probably contain nematocysts and glandular cells. The pigment described by CERRUTI in the same localities may possibly derive from these particles.

In 1951 MATTOX and CROWELL described the polyp and medusa of *Eugymnanthea ostrearum* from Puerto Rico, which is commensal with the mangrove oyster, *Crassostrea rhizophorae*. The polyp is very similar to the one from Japan but the medusa is quite different from the latter in the absence of cirri. The medusa just liberated is 3 mm high and furnished with four simple perradian tentacles and four interradian tentacle bulbs. A medusa of the fifth day after liberation bears eight small adradial tentacle bulbs more. The manubrium has a mouth with four lips. A five day old medusa was observed to show slight indications of gonadal development on the oral surface of the radial canals. Despite the presence of well-developed tentacles in the youngest medusae, they lack cirri at all. Because of the absence of cirri the hydroid was placed near *Eucope* = *Phialella*.

With reference to the previous descriptions of species in the genus *Eugymnanthea* the writer's specimens from Naples are quite different from *E. inquilina* in having the manubrium developed to have a mouth with four lips, elongated perradian tentacles, coiled cirri and gonads covering almost the whole length of the radial canals. These specimens are also distinguishable from *E. ostrearum* in having marginal cirri. They generally agree with *E. cirrifera* and with the medusae from the Imperial Palace, but are distinguishable from them by smaller size, absence of interradian tentacle bulbs, and the arrangement of statocysts and cirri. The writer's specimens, though closely allied to the medusa of *Eugymnanthea*, nearly agree with the genus *Eucheilota*. With the exception of *E. ostrearum*, it is very difficult to distinguish the two genera, *Eugymnanthea* and *Eucheilota* from the medusan characters. Though a definite conclusion must be based on their characters of polyps, I propose here a provisional distinction of them as follows: *Eugymnanthea* with eight statocysts and *Eucheilota* with eight or more statocysts. The writer's medusa, of which the polyp is unknown, has been included in the genus *Eugymnanthea*. In spite of well-developed gonads, they are quite small in size. Therefore, the writer's medusae from Naples will be named as a new species, *Eugymnanthea minuta* n. sp.

So far as is known, polyps of *Eugymnanthea* are morphologically very similar, even parasitic on different hosts, so specific identification must be based on medusan characters. The medusa of *E. cirrifera* and *E. minuta* n. sp. seems to

be closely allied to *Eucheilota* in the possession of cirri, while the medusa of *E. ostrearum* stands near *Eucope*=*Phialella* in systematic position. *Eucheilota* belongs to the family Lovenellidae and *Phialella* belongs to the family Phialellidae. The two families mentioned above are mainly distinguished by the presence or absence of cirri in medusae. As *Eugymnanthea* gives rise to two types of medusae; one similar to *Eucheilota* and the other to *Phialella*, the cirri seem not to be very important. The systematic relationship between the two families must be studied in more detail.

Therefore, the medusae of the genus *Eugymnanthea* will be divided into the following three groups; (a) Degenerated medusa, e.g. *E. inquilina*; (b) Well-developed medusa with cirri, e.g. *E. cirrifera* & *E. minuta*; (c) Well-developed medusa without cirri, e.g. *E. ostrearum*.

The diagnosis of *Eugymnanthea* will be summarized as follows.

#### Genus *Eugymnanthea* PALOMBI, 1935

Lovenellidae with alternation of generations. Polyps epizoid, generally on the Bivalvia, solitary or forming small colonies, with a circlet of filiform oral tentacles and a basal adhesive disc. No thecae. Medusoids budded off from the lower part of polyp. Medusa well-developed or degenerated. Manubrium without peduncle and with four-sided mouth and stomach (or manubrium entirely degenerated). With four radial canals and eight adradial statocysts which are closed containing a few otoliths. Four well-developed hollow perradial tentacles with or without coiled cirri (or only rudimental perradial tentacle bulbs). Gonads develop upon four radial canals.

The synonyms of the genus are *Mytilhydra* CERRUTI, 1941 and possibly *Ostreohydra* YAMADA, 1950. The genus includes the five following species, *E. inquilina*, *E. ostrearum*, *E. japonica*, *E. cirrifera* and *E. minuta*. There are some possibilities that *E. japonica* and *E. cirrifera* will be united, when the medusa of the former is found.

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